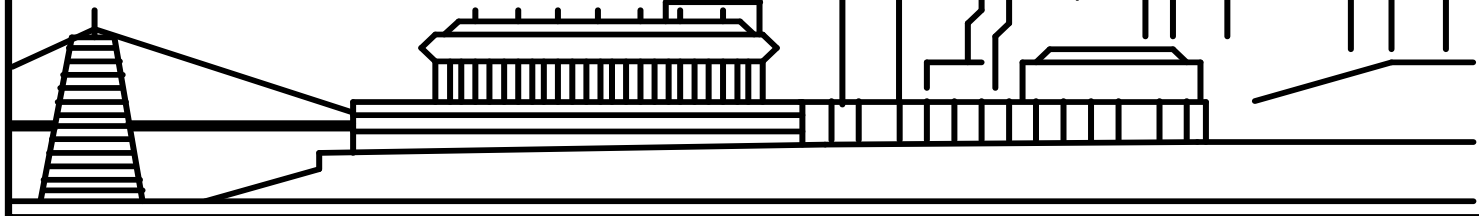




**INSTITUTE OF
ELECTRICAL &
ELECTRONICS
ENGINEERS, INC.**



MARCH 1996

IEEE CINCINNATI SECTION NEWSLETTER

MARCH MEETING U.C. ROCKET TELEMTRY SYSTEM

DATE: THURSDAY, MARCH 21, 1996

PLACE: Institute of Advanced Manufacturing Sciences (Map pg. 9)

TIME: 5:30 (Social Time)

6:00 (Dinner)

7:00 (Program)

8:30 (Approx.-Adjourn)

COST: \$7.00 Members

3.00 Students

9.00 Non-Members

Reservations are required for dinner only!

Please call Dee Scott at

385-9446

by NOON, Wed. March 20th

ABOUT THE PRESENTATION

The University of Cincinnati is currently conducting an effort under the NASA Student Launch Program that will result in a sounding rocket flight this Spring from the NASA Wallops Flight Facility in Virginia. This Project was initiated in the Fall of 1994 to allow UC students to pursue space-related engineering activities. Our meeting this month will consist of a presentation about efforts under way at UC in this area.

The goal of the project was to meet both engineering and scientific objectives. The engineering objective was to create a structurally efficient bus that would provide the necessary services for the experiment packages including a full-duplex error-free telemetry communications system. The science objectives included the following:

- composite nose-cone section with temperature and vibration sensor analysis

- an ultraviolet spectrometer to investigate absorption of solar energy by ozone, oxygen, and atomic oxygen in the lower thermosphere and mesosphere
- automated attitude correction system with dry nitrogen thrusts
- atmospheric mixing experiment with deployable resonant chaff fibers

The rocket itself is a surplus Nike-Orion missile upon which the students design, build, and integrate the upper payload section. This student payload section is approximately 17 inches in diameter and 32 inches long.

Of particular interest is the development of the full-duplex telemetry subsystem led by Cincinnati Section member Christopher Anderson. This system is designed to complete the task of transferring payload data to the ground station during the flight. It was also meant as a vehicle for undergraduate students to pursue a project in the area of communications systems, an area that has been an active professional discipline, but that has received decreasing attention at the undergraduate level in the digital age.

The telemetry system is based upon a complete data link that uses the latest packet-switching techniques to achieve error-free transmission of the payload data. Simply described, the payload data is broken up into packets of information that carry their own error-correcting codes to the ground station. Upon correct reception the ground station then acknowledges the correct reception of the packet by transmitting an uplink signal. In this way, all of the data collected during the experiment can be captured without errors.

CHAIRMAN'S MESSAGE

by

STEVE OLENICK

As part of National Engineer's Week, I had the opportunity to attend the Awards Banquet for the Engineers and Scientists of Greater Cincinnati. This was the 61st meeting honoring accomplished engineers of all disciplines in the Cincinnati area. The honorees included John Niehaus, Jack deMarco, James T. Young and Stanley Trosset. Invited speakers included Cincinnati City Council member Nicholas Vehr, Hamilton County Commissioner Guy Guckenberger and Judge Clyde Middleton. At the end the floor was opened up to questions, many of which centered around the re-vitalization effort of the riverfront and downtown.

On the agenda for the March 21st technical meeting is a presentation by a group of UC students led by Dr. Larry Cooper and Chris Anderson describing their activities involving a telemetry system for a NASA launch program.

A MESSAGE FROM YOUR PACE

CHAIRMAN

"A Network of Professional Activities"

by

BILL LOHNER, PACE CHAIRMAN

We are making progress on bringing a PACE speaker to Cincinnati. After making some inquiries I have obtained the name of the PACE chairman of the Akron Section IEEE who comes highly recommended as a

speaker. Hopefully I will be able to obtain him for the May 23rd Section meeting. More on the meeting next month. Please notify me of any topics you would like discussed.

An activity the Cincinnati Section has undertaken for "Engineer's Week" is as follows: On March 5th I will be going to Connersville High School in Indiana to participate in a presentation to the science students of the IEEE satellite "Faraday Lecture." The actual lecture was given February 7, 1996 and broadcast from Great Britain. The program was taped by the high school. This program will give students the opportunity to view the lecture and presents the IEEE with an opportunity to promote science education, our organization and profession. I am taking with me pamphlets to distribute to the students titled "Engineering and You." This pamphlet tells students what courses to take in high school to prepare for an engineering profession. The pamphlet includes "What do engineers do?", various engineering specialties, "After High School-What?", "How do I pay for college?", and "After college careers with a future". Hopefully the students will be interested and can be encouraged to undertake career in the technical and scientific fields.

Since many of you are interested in E-mail and the Internet I would like to include an excerpt from the February issue of "The Pulse of Long Island", an IEEE newsletter for the Long Island area. It was written by Irwin Weilman, P.E., in his Professional Activities Report column: "IEEE has a number of useful features that are available on Internet and the World Wide Web. If you have access to the Internet you can request an alias to replace the multi-digit name you have received from your present Internet server."

You can get an E-mail alias address by sending an E-mail message to aliases@ieee.org with the following information:

Your E-mail address
First and Last Name
Daytime and Fax Phone Numbers
IEEE Membership Number
Current volunteer activity (if any)

The advantage of doing this is that if you change service providers in the future, you are still accessible from the same address by just notifying IEEE.

IEEE also has a Home page which can lead you to all of the services offered by IEEE. Everything from obtaining technical literature, finding a job, to having IEEE travel service make reservations for you at that Caribbean resort. Their address is <http://www.ieee.org>

Hopefully the above information is of value to you.

Your PACE Chairman
William J. Lohner
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**GEOSYNCHRONOUS SATELLITES
AND TELEVISION
by R. J. REIMAN, HISTORIAN**

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7268

Arthur C. Clarke, distinguished Engineer and science fiction author, conceived the principle of geosynchronous

satellites and for their use for transmission and distribution of communications signals, including radio and television. He was born in Minehead, Somerset, England in 1927. During World War II, he was an officer with the Royal Air Force working with engineers from MIT in England on ground control approach for aircraft landings under restricted visibility. During this period, he proposed the concept of geosynchronous satellites in a publication "Wireless World" in October 1945. Based on the success of Germany's V-2 rocket, a rocket could conceivably be developed which could put a communication satellite in geosynchronous orbit, 22,300 miles above the earth. and he calculated the rocket's velocity, orbital plane, height to be reached, and predicted the geographic coverage or "footprint" that a satellite could cover. He proposed a solar-power supply, the radio-frequency power required to communicate with earth stations, and further predicted manned space stations. He also foresaw problems during solar eclipses with communications.

The first communications satellite, "Sputnik", launched by USSR in 1957, weighed 100 pounds, traveled in a low orbit, but caused consternation in the US. Spurred by this competition, the US Air Force launched "Score" in 1958, followed by the first two-way communications satellite, "Echo", in 1960, a one hundred foot diameter reflecting sphere, followed by "Courier I". Also non-synchronous was AT&T's "Telstar I" in 1962, which could only be used as it passed over the communications area. After the Delta #3914 rocket was developed in 1963, NASA launched the "Syncom" geosynchronous satellites, followed by the "Intelstat" series in 1967-71, for international communications. Attempts to use the Space Shuttle for satellite launching has been a mixed success.

FM is used for the satellite transmission since it does not require highly linear amplifiers, has advantages over AM in noise improvement and the transmission energy can be uniformly distributed across the channel bandwidth. The satellites have antennae for both sending and receiving, are equipped with transponders to both amplify the received ground signal and to shift it to another frequency for transmission, and are solar-powered, with batteries to ride through periods during eclipses. The satellite is equipped to maintain proper orbit, by use of ejecting hydrozene gas in rocket fashion, to position or "station keep" its position. Earth Stations vary from expensive and complicated satellite communications carriers to simple back-yard receiving stations, Round, dish-shaped antennas, that focus the energy in a narrow beam are used, and must be located so as not to interfere with microwave signals.

Satellite use has grown in both national and international radio, telephone and television communications, with increasing regulations needed in areas such as frequency allocation, bandwidth and clearance with microwave signals. The problem of maintaining satellites in orbit has deterred progress, with many of NASA's troubles with the shuttle, and its concentration on manned programs, and absence of reliable disposable rockets.

HELP!!!!!!

by

BOB MORRISON, EDITOR

Do you realize that the largest annual expense our Section incurs is producing, copying and mailing your Newsletter to Section Members ?

In order to help defray these costs and to be able to direct this money to providing more and/or better technical meetings, tours, etc., the Executive Committee is asking that you forward the enclosed insert on advertising (Pages 5 & 6) to any vendors which may call on you and that you ask them to advertise in the our Newsletter.

The Cincinnati Section Newsletter has a distribution of approximately 1000 engineers in this area and would provide a great deal of exposure for an advertiser.

In addition, we are offering various discounts and specials as detailed in the insert.

Your assistance is greatly needed and appreciated!!

**WILSON GREATBATCH: INVENTOR
OF THE IMPLANTABLE
PACEMAKER**
by R. J. Reiman, Historian

Wilson Greatbatch is the inventor of the first successful implantable cardiac pacemaker. He was born September 6, 1919, in Buffalo, New York, is married with five children and six grandchildren. He graduated from Cornell with a BSEE degree in 1950, and is a recipient of an award from the National Inventor's Hall of Fame. He can speak English, French, German and can read technical journals in Russian. His pet peeve is with the regulating agency of the U.S. Food and Drug Administration.

Greatbatch met William C. Chardack, chief of surgery at Buffalo's Veterans Administration Hospital, at a meeting of doctors and electrical engineers who were interested in medicine and biology, and thereby he found a surgeon who was interested in an implantable pacemaker. Paul Zoll had made the first practical pacemaker in 1952, but it was the size of a table radio, and was an external device. Earl Bakken developed a hand-held external pacemaker that was powered with batteries. In 1956, silicon transistors became available and Greatbatch, working for a doctor, made an oscillator with one transistor to aid in recording of fast heart sounds. The oscillator required a 10-k ohm resistor, but he mistakenly substituted a 1-k ohm one and found the circuit was the one that was needed to drive the human heart, since the circuit was self-starting, and would remain constant despite drop in battery voltage. This innovation proved to be successful.

On May 7, 1958, Greatbatch brought Chardack the world's first implantable cardiac pacemaker for implant on a dog's heart. When the heart was exposed to the two pacemaker's wires, it beat in synchrony with the device. Chardack remarked. "Well I'll be damned"!

Greatbatch remarked in his diary in 1959, "I seriously doubt if anything I ever do will ever give me the elation--when my electronic design controlled a living heart". Greatbatch goes on to say "We were pretty naive about early pacemaker designs. We thought that wrapping the module in electrical tape would seal it". He soon found out that the slightest void in the wrapping would allow fluid to enter and short-out the device. Epoxy covering would extend the survival time to four months.

The pacemakers were manufactured by Medtronic, with Chardack "selling" them to the medical profession through papers, case reports, and personal recommendations. For a foreign device to be left in the body by a surgeon was anathema to him, but the pacemaker would be a life enhancer, rather than a life saver and was low risk. Anything was better than nothing. The body itself, warm, wet and saline, would be more demanding as an environment than the deep ocean or outer space.

Parts for the pacemaker were rigidly tested, especially the transistors, and were subjected to on-line tests in dry

ice or to heat soaks at 125 degrees C for 500 hours. Greatbatch's wife Eleanor, a former home economics teacher, administered the shock test of the transistor by taping it with a pencil in the Greatbatch bedroom in Clarence, New York. About 30 percent of the transistors were winnowed out, and none of those that passed ever failed in a pacemaker. Despite the pains taken to ensure reliability of components, many patients died during the early years of artificial pacemaking due to the reactions to the difficult surgery of the first implant, or repeated replacements. Later, surgeon Chardack would refine the existing technique in which a lead with a spring coil was inserted through a vein into the interior of the heart, and open heart surgery was avoided. Now, a pacemaker could be implanted under local anesthesia, but still a problem remained.

Due to limited battery life, pacemakers were only lasting an average of two years with the zinc-mercury battery that had been developed during World War II. Greatbatch went beyond his original training to develop better batteries. Nuclear batteries using plutonium 238 were tried, but their toxicity made them undesirable. In the early 70's, Greatbatch and his colleagues at Hittman Corp. of Columbia, Md. adapted a lithium iodine battery which had been invented by Allan Schneider, to the high reliability demands of pacemakers. Greatbatch's confidence in this battery was so great that he created a company to manufacture them. Today, the \$30 million company, run by his son Warren, sells over 90 percent of the pacemakers batteries! The lithium battery has been called the most significant improvement for pacemakers since its invention. Since the battery does not produce gas as had previous batteries, the pacemaker with this battery could be hermetically-sealed in a metal canister, and thereby operate in a dry, moisture-free environment. The lithium battery extended the life to 10 years!

During his career, Greatbatch's curiosity has lured him into projects on bone growth simulation, electronic control of infection, creating orange trees impervious to frost damage, and most recently to AIDS. He also successfully developed a hybrid poplar tree during the energy crisis as an alternate fuel to oil. The end of the oil crisis and state environmental rulings put a damper on his efforts. He did, however, give cloned flowers to friends including a miniature rose under 7 mm in diameter which he had cultivated in a test tube, and named "Rosemary Cloney". With John Sanford of Cornell University, he has investigated the human immunodeficiency virus, and the two were recently awarded a patent on a way to inhibit a similar viral infection in cats.

He believes that ethics and value are central, money is not, and his concept of "profession" has religious origins from monasteries where one "professed" his faith. In biomedical engineering, he insisted that Engineers receive top billing in their professional journeys, doctors in medical. Professionalism is the theme of Greatbatch's favorite speech to students. He urges them , "Don't fear failure. Don't crave success," and "that the reward is not in the results, but rather in the doing."

IEEE NEWS

IEEE OFFERS JOURNALISTS FREE TECHNICAL SOURCE GUIDE

Piscataway, N.J., December 13, 1995 -- A new publication from the IEEE provides multi-disciplinary scientific and engineering sources on a wide range of technical topics.

Designed as a handy resource for journalists, the IEEE *1996 Technical Expert Guide* includes more than 500 topics related to electrical and electronics engineering and computer science. The 40-page guide has an

alphabetized list of entries and contact information for IEEE experts and others in industry, government and academia who are qualified to answer questions or make referrals for a particular subject area.

For a complimentary copy of the IEEE *1996 Technical Experts Guide* contact Marsha Longshore at 908-562-6824 (voice), 908-981-9511 (fax) or m.longshore@ieee.org (e-mail).

IEEE-USA TO HOST NINTH BIENNIAL CAREERS CONFERENCE

Washington, D.C., January 4, 1996 -- The U.S. Activities division of the IEEE (IEEE-USA) will host its Ninth Biennial Careers Conference on April 11 - 12, 1996, in Minneapolis. The conference theme, "Winning in a Global Economy: Helping Engineers Develop Career Resilience," will emphasize new information that can help organizations, managers and engineers create environments for successful, effective engineering careers.

Focusing on success stories of individuals and the organizations where they work, the conference goal is to encourage and equip engineers for fruitful careers in an era of globalization, re-engineering, downsizing and outsourcing. Participants will learn from and exchange ideas with experts from some of America's leading businesses and institutions, including AT&T Bell Labs, Du Pont, 3M, Exxon and Texas Instruments.

The conference will offer sessions on organizational success stories, surviving and thriving in today's career environment, strategies and skills for career successes, new career roles for engineers, and educating engineers for work in the 1990s and beyond. Workshops will concentrate on career transitions and conflicts, and keynote speaker Michael Bonsignore of Honeywell will give a CEO's perspective on career development for engineers.

For more information or to register, contact IEEE-USA's Scott Grayson at 202-785-0017, ext. 339 (phone); 202-785-0835 (fax); or s.grayson@ieee.org (e-mail); or access IEEE-USA's World Wide Web site at <http://www.ieee.org/usab>.

SLOAN FOUNDATION GRANTS IEEE \$464,000 FOR INTERACTIVE CAREER GUIDANCE PROGRAM

Piscataway, N.J., February, 1996 – A \$464,000 grant for developing interactive career guidance materials for high school and college students has been received by the IEEE. The grant from the Alfred P. Sloan Foundation will be used to encourage students to seek careers in electrical and electronics engineering and computer science.

Under the two-year grant, the IEEE will develop a video series of case histories and a CD-ROM depicting the engineering work experience in various employment settings. The project, called "Interactive Student Career Guidance in Electrical and Electronics Engineering," also will establish an on-line career information data base on the World Wide Web for use in career planning and employment searches. This data base will contain information on salaries, undergraduate and graduate programs, and state licensing requirements, and will link to companies that employ engineers.

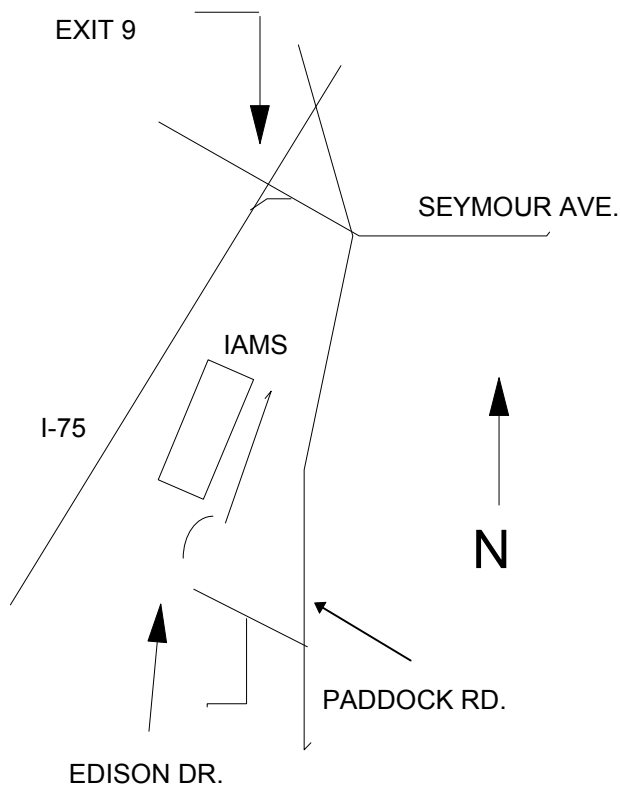
It will also contain survey data to offer undergraduate students a bird's-eye view of the field and a close look at engineering specialties. In addition, the IEEE also will develop a mentoring service coordinated by an IEEE Student Branch Mentoring Program that will help put students in touch with industry mentors on-line.

The Institute will coordinate these activities with other organizations also funded by the Sloan Foundation, including the American Society of Mechanical Engineers, the American Institute of Physics and the Association for Computing Machinery.

The Interactive Student Career Guidance Program Builds on prior IEEE projects including Industry 2000, 1994 conference discussing the skill, education and training needs of industry and partially funded by the Sloan Foundation. It also ties closely to such programs as the IEEE Skills Assessment Forum, the Career Asset Manager and the Lifelong Education Curricula Development project specially designed to help students, make decisions on specialty development and employment in engineering.

For more information about the IEEE Interactive Student Career Guidance Program contact Dr. Peter Wiesner, Project Director, IEEE Educational Activities, 445 Hoes Lane, Piscataway, N.J 08855-1331, phone no. (908) 562-5500.

MAP TO IAMS



Dee Scott (call for meeting reservations)
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Bob Haas - Vice Chairman

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MARCH 1996

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**The Institute of Electrical and
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